Plotting Critical Research-Practice in Digital Art

Martin Zeilinger, PhD, Senior Lecturer in Media,
Anglia Ruskin University

> 'In a technological society, there is, at least in principle, no fundamental difference between research and artistic productivity.'
> Max Bense[1]

This short essay introduces my ongoing project *Pattern Recognition*, which explores how evolving machine agency in artist–computer collaboration impacts our understanding of concepts such as 'authorship' and 'cultural ownership'. Based on the appropriation and reworking of early works of computer art, *Pattern Recognition* develops a combined critical and artistic approach, in which detailed analysis of the original works is an inevitable prerequisite for reworking them artistically. In this way, 'authorship', 'creative agency' and 'originality' are engaged both critically and creatively, and

1 '[…] im Rahmen einer Technischen Zivilisation [besteht] wenigstens im Prinzip kein essentieller Unterschied zwischen wissenschaftlicher und künstlerischer Produktivität.' (Max Bense's formative work in German has by and large not been translated into English.) See Max Bense, *aesthetica IV, Programmierung des Schönen. Allgemeine Texttheorie und Textästhetik*, Baden-Baden and Krefeld: Agis, 1960,128 pp, PDF available online.

the project contributes to ongoing aesthetic discourse on digital art practice, while simultaneously intersecting with emergent socio-legal issues connected to contemporary art. Interloping on both theory and practice, the project lastly also provides a context for exploring the critical role artistic practice can play in – or as – research.

Pattern Recognition takes early graphical computer art both as its research subject and as the object for its appropriation-based artistic interventions. After choosing original works representing pioneering examples of the artistic use of programming and computer technology (by artists such as Georg Nees, Vera Molnár, and Frieder Nake), I engage the works in a multi-step process that begins with an extensive analysis of their algorithmic logic, and then continues on to reproduce them 'from scratch', including the rewriting of the underlying source code and the construction/modification of required reproduction hardware (such as simple table-top pen plotters). Inhabiting all the steps involved in the (re-)creation of the chosen works as fully as possible expands my theoretical and practical understanding and appreciation of the works in question significantly, and also serves as the basis for exploring – again, both theoretically and practically – various aspects of the artistic human–computer collaboration underlying generative and algorithmic art-making. The appropriation-based approach developed in *Pattern Recognition* thus becomes a framework for rethinking the contours and nature of the digital artwork itself,

and in doing so also to think about the complicated relationship between artist–computer–artwork on the one hand, and the viewing public on the other. Does contemplative 'looking at' a digital artwork entail analysing its source code? Wherein does a 'work' of graphical computer art consist – is it manifest in a unique object (such as a print or canvas-based work), or is it embodied in the code itself? If so, does 'copying' such an artwork require access to the original source code, and what kind of engagement with the work is signified by the (approximate) recomposition of the code? Where and how is artistic agency situated if artist and computer rely upon one another in producing the artwork? Does it still make sense to speak of an 'artist' in the traditional sense when the resulting artwork in question is based on generative algorithms that will yield different outputs every time they are run? How, finally, does the generative nature of an artwork critically inflect the questions above?

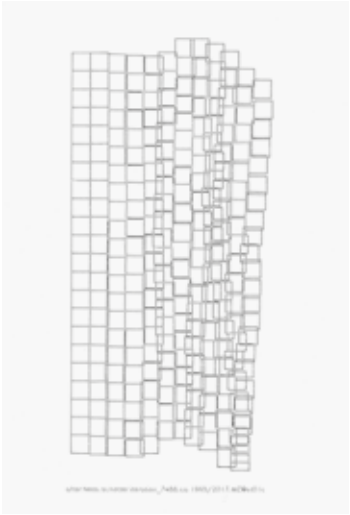
Iterative Schotter, a key component of *Pattern Recognition*, is a good example of the type of conceptual and artistic work researched and produced in the project (Figures 1–4 show a selection of the 15-part series). The work comprises a series of plotter drawings that are based on a well-known computer-generated artwork, *Schotter* (ca.1968) by the German artist Georg Nees (1926–2016). As with all parts of *Pattern Recognition*, my goal in producing these images was to better my understanding and appreciation of the original work, to consider what

the creative act of appropriation entails in the context of generative art-making, and to allow this critical process to simultaneously draw upon and result in an artistic intervention with the original.

Georg Nees produced *Schotter* while working as an engineer at Siemens AG and while studying philosophy and mathematics with Max Bense, whose work greatly impacted the majority of early computer artists. S*chotter* was programmed on a Siemens System 2002 computer built in the mid-1950s, and plotted using an early Zuse Graphomat pen plotter (images of *Schotter* are widely available online[2]; Figure 5 provides my recoding of a program capable of visually reproducing the original). *Schotter* consists of a simple yet intricate graphical pattern featuring randomised elements. It shows 22 horizontal rows of 12 squares each, cascading from the top towards the bottom of the image.[3] Each row introduces a minor, random positional offset as well as a random rotation value for each square. In each subsequent row, positional offset and rotation naturally amplify, creating the impression that towards the opposite image border, the squares spread apart and scatter more and more. Importantly, the randomised elements of the design are determined algorithmically

2 Images of Nees' famous original can be found in many places online; for example at www.medienkunstnetz.de/works/schotter and at http://collections.vam.ac.uk/item/O221321/schotter-print-nees-georg.

3 Note that Frieder Nake, a pioneering computer artist and Nees' contemporary, tells an anecdote according to which Georg Nees, when asked about the correct orientation of the artwork, responded that he did not care whether the piece was displayed as cascading or ascending squares.



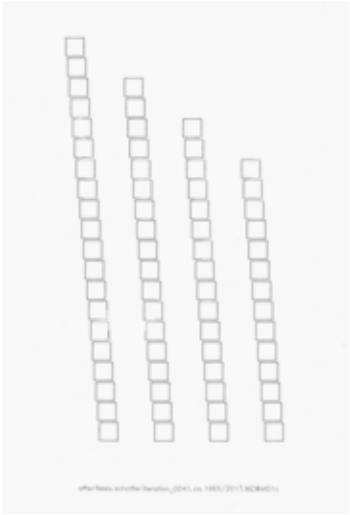


Fig. 1
after Nees, schotter iteration_7488, ca. 1965/2017, MZ@st01c.
Image courtesy of the artist.

Fig. 2
after Nees, schotter iteration_0041, ca. 1965/2017, MZ@st01c.
Image courtesy of the artist.

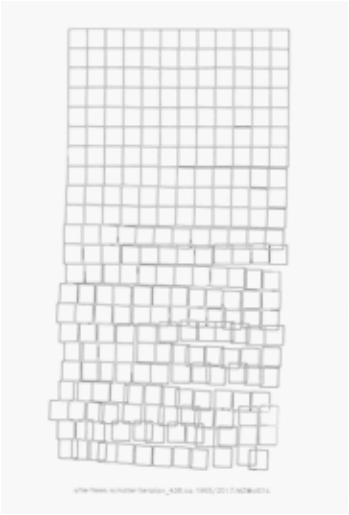


Fig. 3
after Nees, schotter iteration_438, ca. 1965/2017, MZ@st01c.
Image courtesy of the artist.

Fig. 4
after Nees, schotter iteration_7780, ca. 1965/2017, MZ@st01c.
Image courtesy of the artist.

each time the source code of *Schotter* is run, meaning that each execution of the underlying algorithm will result in a different image.

In line with the approach developed for *Pattern Recognition*, my goal in reworking *Schotter* was to 'inhabit' all aspects of (re-)creating and (re-)producing the work. I began by looking at *Schotter* and contemplating the algorithmic logic underlying the image composition. I then proceeded to write code, in an iterative manner, with the goal of approximating the appearance of the original. In this process, I allowed errors and mistakes to persist, as their output is itself instructive concerning the aesthetic and computational ideas encoded in the original. For other components of *Pattern Recognition*, I had already constructed and/or modified a number of table-top and wall-hanging plotters, which offer a simple but efficient approximation of the industrial plotters used by Nees and other early computer artists, and which I could use to externalise the code's output on paper. These simple plotters, generally controlled by custom software and a number of microprocessors, feature frames that guide a pen travelling along X/Y axes, and include a component designed to raise/lower the pen.[4] My code for *Iterative Schotter*, written in the Processing programming language, outputs vector graphics that can be interpreted and put to paper using the plotter.[5]

4 The images of *Iterative Schotter* shown in Figures 1–4 were produced using an AxiDraw V3 plotter with minor hardware modifications and custom software.

5 Processing is an open source programming language popular among digital artists. (See https://processing.org).

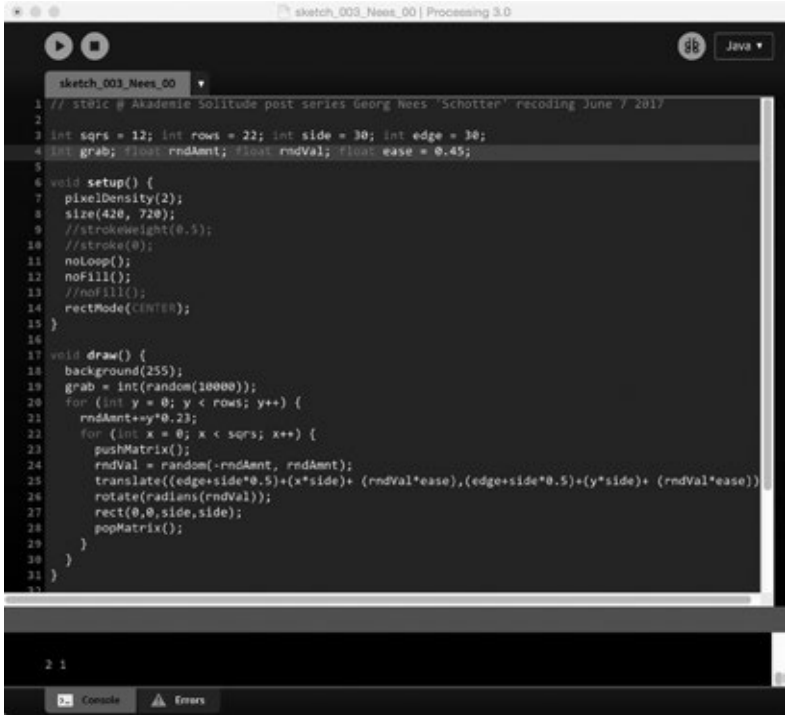


Fig. 5
Recoding of Georg Nees' Schotter in the Processing programming language. Image courtesy of the artist.

The overall process is best described as a combination of research and creative practice, in which neither is privileged: analysing *Schotter* benefits from experimentation with the work's recreation, just as recreating it depends on a thorough analysis of the original. *Pattern Recognition* thus yields what might be considered original artworks (or, in any case, artworks that problematise the concept of originality), while

simultaneously facilitating the development of a set of DIY techniques that serve as both creative and analytical tools. In combination, these open up new ways of seeing digital artworks, by experimenting with ways of re-making them. Because this process is appropriation-based and highly technical, along the way it inevitably foregrounds questions regarding the figure of the artist/author of digital art, as well as questions regarding the shifting nature of the art object in digital contexts.

Perhaps unsurprisingly, many such questions were already being asked by the early computer artists whose work I engage with in *Pattern Recognition*. Critical engagement with their experimental work, beginning with the production of paper-based graphics using computer programs towards the end of the 1950s, thus also takes on an art historical, or media archaeological component. Georg Nees himself was a key figure in this development, and he, too, saw his work positioned between theory and practice.[6] Arguably, *Pattern Recognition* is a critical continuation

6 Nees' work featured in the first exhibition of computer art. The exhibition (at Studiengalerie TH Stuttgart) opened in February 1965, two months before the second seminal computer art exhibition, featuring the work of A. Michael Noll, took place at Howard Wise Gallery in New York City in April of the same year. Nees was studying mathematics, philosophy, and physics in Stuttgart, while also working as an engineer for Siemens AG. Like Frieder Nake, who was completing a PhD in mathematics at the same university, Nees worked closely with the German philosopher of science, aesthetics, logic, and semiotics Max Bense, who taught at the Technische Hochschule Stuttgart. His (largely untranslated) writing on the concept of *Informationsästhetik* (information aesthetics) and many other topics situated at the intersection of art and science played a key role in shaping the conceptual and practical approaches of Nees, Nake and many others.

of the practice-based theorisation begun by Nees and many others, through the project's excavation of early discourse on algorithmic authorship, the nature of digital art, and the evolving role of the computer in art-making.

These topics were a central concern for Nees and others experimenting with using computers as part of their creative practice. Rather than framing their work as 'computer-generated art based on research' or as 'research informed by artistic practice', most of the practitioners who are today labelled 'early computer artists' strongly resisted conventional labelling of their work at the interstices of the previously discrete domains of art and science/research. Michael A. Noll, for example, famously wrote that '[r]ather than risk an unintentional debate at this time on whether the computer-produced designs are truly art or not, the results of the machine's endeavours will simply be called "Patterns".'[7] Nake was similarly hesitant to draw on existing essentialist taxonomies and, instead of situating himself as the sole creator of discrete artworks, foregrounded instead the mutually beneficial 'teamwork' between artist and computer that affords both critical and aesthetic innovation.[8] Teamwork here evokes a quasi-non-hierarchical collaboration between human and computer/machine that points towards

7 Michael A. Noll in an internal memorandum at Bell Laboratories, August 28, 1962.

8 See Frieder Nake, 'Teamwork zwischen Künstler und Computer', in *Ästhetik als Programm*. Max Bense/Daten und Streuung, Eds. Barbara Büscher, Hans-Christian von Herrmann and Christoph Hoffmann. *Kaleidoskopien 5*: 2004. pp.220–225.

a redistribution of creative agency, artistic licence, aesthetic vision, and ethical responsibility between the team members involved – all of these concerns found their expression in the work of early computer artists as the subjects of both artistic experimentation and technical, scientific and aesthetic research.[9]

Max Bense's writing is saturated with a similar focus on collaborative work performed by computer and artist at the interstices of creative and critical work: 'The "human-machine" team functions through mutual exchanges, in which the machine might simulate the consciousness of the human just as the human participant might seek to approximate the automatism of the machine.'[10] Virtually all artist-researchers involved in early digital art have, indeed, commented on the important congruences between scientific and artistic experimental uses of computer technology. While today, we don't hesitate to label the results of this experimentation as art, much early work was instead discussed as 'non-numerical data processing' (*nicht-numerische Datenverarbeitung* – thus also the title of an important anthology on the subject published by Rul Gunzenhäuser in 1968).

9 Frieder Nake's Walk-Through-Raster series, begun in the mid-1960s, and now in the collection of the V&A, is a good example of the critical exploration of computational/technical properties expressed artistically. (See http://collections.vam.ac.uk/item/O214165/walk-through-raster-series-2-photograph-nake-frieder).

10 (Author's translation from German; in the original: 'Das Team "Mensch-Maschine" ist zu einem wechselseitigen geworden, in dem die Maschine … nicht nur das Bewusstsein des Menschen simuliert, sondern der Mensch unter Umständen den Automatismus der Maschine nachahmt.' Bense cit. in von Herrmann, 'Programmierung des Schönen', in *Ästhetik als Programm* (op. cit), 162.

This denomination served, again, to build a bridge both to research in informatics and communication theory, and to the extra-scientific, aesthetic contexts in which artists like Molnár, Nees, or Noll were immersed. Often with reference to Bense's *Informationsästhetik* and related philosophical and media theoretical projects, they exhibited a preference for substituting the idea of the conventional artwork with the much broader, open-ended concept of 'objects that are exposed to aesthetic judgement'.[11] As an extension of this approach, 'generative aesthetics', the framework within which much early computer art was produced, 'refers to the summary of all operations, rules, and theorems which can, when applied to a number of material elements that can be classified as signs, serve to consciously and methodically create […] aesthetic states/conditions'.[12]

Working on *Pattern Recognition* has made me a better programmer (I have greatly improved my ability to 'read' visual patterns encoded in software, and also to algorithmically express visually complex ideas of my own) and a better engineer (by now I have built a small fleet of pen plotters and drawing robots of varying complexity and ability). But more importantly, *Pattern Recognition* continues to challenge me to recognise and explore the manifold intersections between art and research. As noted,

11 Cf. Barbara Büscher, 'Vom Auftauchen des Computers in der Kunst', in *Ästhetik als Programm* (op. cit.), 229.

12 (Author's translation) Max Bense in Georg Nees, *Generative Computergraphik* (1969), Eds. Hans-Christian von Herrmann and Christoph Hoffmann, *Kaleidoskopien 6* (2006), 11.

in this project arguments concerning what it means to author, own, or copy works of art in digital contexts are addressed theoretically while also being embodied practically. Arguably, the outcome actively contributes not only by producing artworks, but, more importantly, by engaging with critical concerns that circulate in aesthetics, media theory and intellectual property theory. Picking up and extending this long-standing debate concerning artistic appropriation in analogue media environments,[13] *Pattern Recognition* thus not only argues, but also seeks to demonstrate practically, that 'authorship', in contexts of procedural, process-oriented and generative art-making, is a category that is becoming less and less stable. In collaborations between computer and artist, the meaning of creativity clearly shifts, and the artistic agency that must be credited for the output (the artwork) is linked more and more tightly to the operations of algorithmic structures. In traditional artistic crafts, such as the writing of a poem or the drawing of a picture, it may have appeared to be relatively easy to identify a conventionally understood artist as the sole source of the creative expression (even though these art forms were, like virtually all others, mediated through once-technological innovations such as pen and paper).

As early computer artists insisted, and as *Pattern Recognition* shows, using technology – 'collaborating'

13 My PhD thesis, *Art and Politics of Appropriation* (University of Toronto 2009), sketches some of these debates beginning in the early 20th century.

with it – reshapes the meaning of creative practice, to the point where labelling its outputs simply as 'art' seems inaccurate and insufficient. This applies in particular when the reliance on technology involves computation or algorithmic operations. At the outset of the relatively short history of computer art, experiments with the creation of graphical patterns and stochastic poetry[14] made clear that this kind of creative work always also represented research. As 'non-numerical data processing' became computer art, the refusal of early experimental practitioners to choose between binary options ('Is this art or research?') was a commitment to developing truly new frameworks for, and approaches to, digital art-making and human-computer interaction. For better or worse, this is also how *Pattern Recognition* operates. It experiments with artistic traditions of appropriation as much as it contributes to the critical interrogation of the collision between aesthetics and intellectual property concepts in digital contexts; it is media theory as much as it is media art history as much as it is a kind of media art.

An often cited claim by Vilém Flusser postulates: 'With digitisation, all art forms become exact scientific disciplines, and artistic practice can no

14 The term refers to the generation of poetry using algorithmic process and databases of text. Theo Lutz (1932–2010) – another engineer studying information theory with Max Bense – is generally credited with having pioneered the art form in the late 1950s, using a Zuse Z22 computer.

longer be distinguished from research.'[15] In a similar vein, Bense's work on *Informationsästhetik* proposes that divisions between technology and art would eventually be transcended, allowing for the emergence of ideas that are radically critical of established perspectives. To close, this might be a good way to begin describing the characteristics and aims of both historical and current research-creation experiments that involve algorithmic processes in the production of critical artistic content – through and beyond the domain-specific binds in which artists and researchers, respectively, still often find themselves.

15 (Author's translation from German; in the original: 'Alle Kunstformen werden durch die Digitalisierung zu exakten wissenschaftlichen Disziplinen und können von der Wissenschaft nicht mehr unterschieden werden.'). See Vilém Flusser, 'Digitaler Schein', in Ed. Florian Rötzer, *Digitaler Schein. Ästhetik der elektronischen Medien*. Frankfurt/Main: 1991, 158.

Biography

Martin Zeilinger is an Austrian, London-based new media researcher, practitioner and curator. Holding a PhD in Comparative Literature (Univ. of Toronto), Martin has been teaching media theory and media arts for over a decade, and currently serves as Senior Lecturer in Media at Anglia Ruskin University. Martin's work focuses on appropriation art, intellectual property issues in contemporary art, digital art and emerging financial technologies, and the use of video game technologies in experimental media art, among other topics. His critical work is widely published in books (most recently *MoneyLab Reader 2* and *Artists Re:Thinking the Blockchain*) and in journals including *Philosophy & Technology* and *Computer Music Journal*. Since 2014, Martin has been co-curator of the Toronto-based Vector Game Art & New Media Festival. *Iterative Schotter* has been exhibited at the group exhibitions *processing* (Galerie Peithner-Lichtenfels, Vienna/AUT, 2017) and *Rethinking Affordance* (Akademie Schloss Solitude, Stuttgart/GER, 2018). Martin's publications and information about his curatorial projects and art practice are available at http://marjz.net.

Pattern Recognition

Pattern Recognition was initiated during a four-month research-creation residency in the 'art, science, and business' programme at Akademie Schloss Solitude, which Martin was awarded for an ongoing project on algorithmic authorship. Akademie Schloss Solitude is a public foundation in Stuttgart/Germany that provides substantial support for interdisciplinary experimental projects by artists and research-practitioners.